

## ORIGINAL RESEARCH

# Incidence of asymptomatic SARS-CoV-2 infection in children undergoing elective otolaryngologic surgery throughout the COVID-19 pandemic

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**Abstract**

**Objective:** Children infected with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) are less clinically affected than adults, with most cases presenting as asymptomatic or mildly symptomatic. However, true rates of asymptomatic SARS-CoV-2 infection in children remain unclear. We sought to examine rates of SARS-CoV-2 in asymptomatic children and the role of children in transmission.

**Methods:** We performed a retrospective review of patients between 6 months and 17 years of age who underwent elective or semi-elective otolaryngologic surgery with physicians affiliated with Weill Cornell Medicine between May 15, 2020 and March 31, 2022. Patients were included if they received molecular assay testing for SARS-CoV-2 without SARS-CoV-2 symptoms within 5 days of scheduled surgery. SARS-CoV-2 infection status, exposure, clinical symptoms, demographic data, and insurance status were recorded.

**Results:** 1047 patients met inclusion criteria. Thirteen positive cases (1.24%) were identified in the study population. Six cases occurred between December 2021 and February 2022 following the classification of the omicron variant as a variant of concern in November 2021. Five of the 13 cases occurred in children under 2 years of age. Seven patients were male, and five were female. Residences spanned all five boroughs of New York City and the surrounding metropolitan area.

**Conclusion:** Throughout the pandemic, children have had a low rate of asymptomatic disease and likely pose a low risk of transmission of SARS-CoV-2 to the general population. Our results suggest that testing of asymptomatic children is a low-yield practice that is unlikely to influence rates of SARS-CoV-2 in the general population.

**Level of Evidence:** 3.

**KEYWORDS**

asymptomatic COVID-19, asymptomatic testing, asymptomatic transmission, pediatric COVID-19

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## 1 | INTRODUCTION

Since the earliest stages of the coronavirus disease 2019 (COVID-19) pandemic, it has been known that children infected with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) are less clinically affected than adults, with most cases presenting as asymptomatic or mildly symptomatic.<sup>1,2</sup> However, rates of asymptomatic SARS-CoV-2 in children are not well documented. Given the absence of severe symptoms in children, rates of infection are likely underestimated as asymptomatic children are less frequently tested.<sup>3</sup> This underestimation is of particular importance regarding the initial months of the pandemic. As the pandemic progressed beyond the early months of 2020, the number of reported pediatric cases increased, interpreted by numerous studies to reflect broader testing among children, rather than higher rates of infection, compared with the early months of the pandemic.<sup>4</sup> Therefore, the true rate of SARS-CoV-2 infection in asymptomatic children throughout the early months of the pandemic and even beyond remains unknown.

Although SARS-CoV-2 rarely presents severely in pediatric patients and risk of transmission of SARS-CoV-2 infection from an asymptomatic individual is less than from a symptomatic individual, asymptomatic pediatric patients still have the potential to contribute to the spread of infection.<sup>5</sup> Studies have estimated that asymptomatic and pre-symptomatic or “silent” disease accounts for over 50% of the transmission of SARS-CoV-2 in COVID-19 outbreaks.<sup>6</sup> Therefore, identifying these “silent” carriers of SARS-CoV-2 by widespread testing and contact tracing is essential.

Despite this recognition that children can play a significant role in the further dissemination of SARS-CoV-2, there are few studies that have sampled the incidence of active SARS-CoV-2 in the asymptomatic pediatric population without known exposure to SARS-CoV-2. Because otherwise healthy children are routinely tested for SARS-CoV-2 within 5 days of a surgical procedure, this population allows the opportunity to examine the presence of active SARS-CoV-2 in asymptomatic children. The existing literature on preoperative SARS-CoV-2 screening results in children undergoing surgical procedures is based largely on rates of COVID-19 in the early months of the pandemic when many hospitals canceled elective surgery and prior to the emergence of more virulent strains of SARS-CoV-2.<sup>7,8</sup>

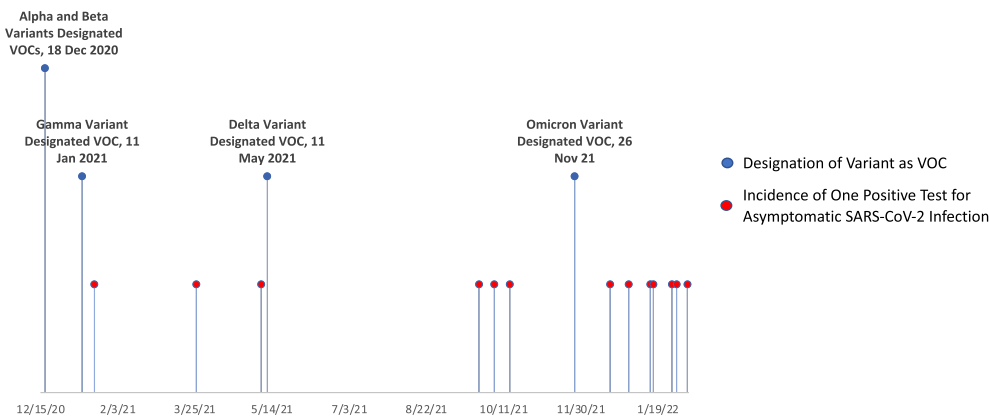
In this study, we examined rates of SARS-CoV-2 infection in asymptomatic children younger than 18 years of age in the New York metropolitan area starting during the first wave of the COVID-19 pandemic and through the emergence of the multiple SARS-CoV-2 variants known to have higher transmissibility and increased impact on morbidity and mortality.<sup>9</sup> Through this study, we investigated how the incidence of SARS-CoV-2 in asymptomatic children and the potential role of children in transmission of the virus have evolved throughout the different phases of the COVID-19 pandemic. Identifying the asymptomatic rate of SARS-CoV-2 in children who comprise 20% of the population of one of the initial epicenters of COVID-19, as well as one of the largest cities in the United States, is vital for the construction of future public health initiatives.<sup>10</sup> Understanding the role of children in

**TABLE 1** Patient characteristics

Characteristic	No. of patients	%
<i>Age, y</i>		
≤1	284	27.1
2–4	299	28.6
5–7	202	19.3
8–10	109	10.4
11–13	68	6.5
14–17	85	8.1
<i>Sex</i>		
Male	618	59.0
Female	429	41.0
<i>Race</i>		
American Indian/Alaska Native	5	0.5
Asian	49	4.7
Black or African American	108	10.3
Other/Unknown/Not reported	545	52.0
White	340	32.5
<i>Ethnicity</i>		
Hispanic or Latino	88	8.4
NOT Hispanic or Latino	459	43.8
Unknown/Not reported	500	47.8
<i>Residence</i>		
Bronx	60	5.7
Brooklyn	243	23.2
Manhattan	266	25.4
Queens	222	21.2
Staten Island	23	2.2
New York State	120	11.5
Other	113	10.8
<i>Insurance Status</i>		
Commercial	733	70.0
Medicaid	298	28.5
None	11	1.0
Unknown	5	0.5
<i>Location of Testing</i>		
Commercial Lab	362	34.6
Point of Care	685	65.4
<i>COVID-19 test result</i>		
Negative	1034	98.8
Positive	13	1.2

transmission through the stages of the pandemic can provide insight into decision-making regarding the implementation of social-distancing measures, such as school closures, as well as the practice of testing asymptomatic children in general. Our study is the first to examine this critical question in the New York metropolitan area which houses the country's largest school system.

**FIGURE 1** Timeline of incidence of positive tests for asymptomatic SARS-CoV-2 infection and designation of SARS-CoV-2 variants as variants of concern (VOCs) by the World Health Organization (WHO)



## 2 | MATERIALS AND METHODS

We performed a retrospective review of patients between 6 months and 17 years of age who were scheduled to undergo elective or semi-elective otolaryngologic surgery with physicians affiliated with Weill Cornell Medicine between May 15, 2020 and March 31, 2022. Universal preoperative screening for COVID-19 for all patients undergoing surgery for any reason was instituted in the state of New York on April 29, 2020. Patients received testing by molecular assay testing at their pediatricians' offices, surgeons' offices, or at the affiliated hospitals. PCR testing was universally used. Patients who did not have record of undergoing molecular assay testing for SARS-CoV-2 by PCR within 5 days prior to their scheduled surgeries were excluded. Patients were excluded if they were symptomatic of SARS-CoV-2 infection with fever or chills, cough, muscle or body aches, or any other reported symptoms within 5 days of their scheduled surgery, as documented in the medical record. For each patient included in the study, SARS-CoV-2 infection status in preparation for surgery based on testing, exposure to a family member with active SARS-CoV-2 infection, demographic data, and insurance status were recorded. The study was approved by the Institutional Review Board at Weill Cornell Medicine.

## 3 | RESULTS

1047 patients met inclusion criteria for the study. As captured in Table 1, of 1047 patients, 618 (59%) were male and 429 (41%) were female. 78% of all patients were from New York City: 60 patients were from the Bronx, 243 from Brooklyn, 266 patients from Manhattan, 222 from Queens, and 23 from Staten Island. One hundred and twenty patients were from the surrounding New York area, and 113 patients were from out of state. Among the 1047 patients, 70% were commercially insured while 28% of patients were insured by Medicaid, and 1% was uninsured.

Thirteen cases of asymptomatic SARS-CoV-2 infection were identified in the study population. Overall, this produced an incidence rate of 1.24% in our study of asymptomatic children undergoing elective or semi-elective otolaryngologic surgery with physicians affiliated with

Weill Cornell Medicine between May 15, 2020 and March 31, 2022 in New York City. As shown in Figure 1, of the 13 positive cases, six cases occurred between December 2021 and February 2022 following the classification of the omicron variant as a variant of concern on November 26, 2021. The remaining seven cases were spread throughout the study period. In the study population, during the three-month period of December 1, 2021 to February 28, 2022, the rate of positivity was 3.59%. Five of the thirteen total positive cases occurred in children under 2 years of age. Of the 13 patients, seven were male, and five were female. The residences of the 13 patients spanned all five boroughs of New York City as well as New York State. Nine of the 13 were commercially insured, and the remaining four were insured by Medicaid. Between the patients who tested positive and those who tested negative, the distributions of race, sex, age, and insurance type were comparable.

## 4 | DISCUSSION

Throughout the course of the pandemic, the ability of children to be asymptomatic carriers of SARS-CoV-2 has raised valid concern, especially as schools struggled to remain open in the fall of 2020. Children are more commonly affected by upper respiratory tract infections (URIs) than adults, with the average child having 6–8 URIs per year. In contrast, there is a lower prevalence of SARS-CoV-2 infection in children than in adults. It has been documented that children have lower rates of symptomatic disease than adults and are less likely to suffer from severe disease if affected.<sup>3,11</sup> However, the concern remains that children can be asymptomatic carriers of disease and lead to the infection of others who may be more susceptible to symptomatic disease, especially as the true rate of SARS-CoV-2 infection in asymptomatic children remains unclear.

Few studies have investigated the asymptomatic transmission of SARS-CoV-2 in children. One study seeking to characterize the transmission dynamics of SARS-CoV-2 within families found the prevalent transmission direction in infection clusters to be adult-to-child followed by adult-to-adult with no evidence of child-to-adult or child-to-child transmission. Consistent with the larger body of literature, in this study, children were more likely to have an asymptomatic infection

compared with adults (40% vs. 10.5%), and adults were more likely to develop a severe infection compared with children (8.8% vs. 0%).<sup>11</sup> Of course, one notable severe complication of SARS-CoV-2 infection to which children are susceptible is multisystem inflammatory syndrome in children (MIS-C). However, this complication is rare, estimated to occur in less than 1% of children with SARS-CoV-2 infection. Similarly, another study aiming to characterize transmission dynamics of SARS-CoV-2 in children and families found that the most common source of infection among families was the parent; in only 8% of households did a child develop symptoms before any other household member.<sup>12</sup> The literature suggests that the pediatric population is not a major vector of SARS-CoV-2. However, the bulk of studies examining asymptomatic transmission of SARS-CoV-2 in children was conducted largely within the early months of the COVID-19 pandemic. Since then, new variants with increased impact on morbidity and mortality have emerged, and there is a need for better understanding of the incidence of infection in children and transmission dynamics in children throughout this evolution.

Our findings demonstrate a low incidence of SARS-CoV-2 infection in our sample of asymptomatic children throughout both the initial wave of COVID-19 and the sequential emergences of the variants that followed. The low rate of SARS-CoV-2 in our study population did not allow us to make any conclusions about the incidence of SARS-CoV-2 in children based on socioeconomic status, ethnicity, or race. Other authors have shown stark demographic associations, such as higher rates of positivity in children of lower income households compared with children in the top quartile for income and higher incidence of SARS-CoV-2 exposure in Black and Hispanic populations.<sup>13</sup> We recognize the importance of investigating these associations, and we hope to characterize the disparities in COVID-19-related illness in the future in pursuit of aiding public health officials to concentrate their resources in our most affected communities.

The low rate of SARS-CoV-2 in our population, however, contributes valuable insight into understanding the dynamics of SARS-CoV-2 in asymptomatic children throughout the pandemic as well as what measures to limit the spread of SARS-CoV-2 may or may not be effective. Multiple studies have indicated that school closures have had an equivocal, if not limited, impact on reducing SARS-CoV-2 transmission, but there remains concern that children could be asymptomatic carriers of SARS-CoV-2.<sup>14</sup> Our findings suggest that the rate of SARS-CoV-2 positivity in asymptomatic children undergoing elective and semi-elective otolaryngologic surgery from May 15, 2020 to March 31, 2022 is low, less than 1.25% in the metropolitan New York area. The percent positive rate in New York City during the study period ranged from a high of 22.7% on December 31, 2021 to a low of 0.3% on June 19, 2021 with notable spikes at the beginning of January 2021 and at the beginning of January 2022.<sup>15</sup> The largest spike in percent positive rates in New York City to date occurred during the 3-month period following the classification of the omicron variant as variant of concern on November 26, 2021. Consistent with the higher incidence of positive cases in New York City following the identification of the omicron variant, our study demonstrates a higher rate of positivity in children during the same 3-month period, 3.59%

compared with the overall positivity rate in our sample of 1.24%. There were no other identifiable clusters of positivity within our dataset. Overall, our study emphasizes that children have had a low rate of asymptomatic disease throughout the multiple stages of the pandemic and, as a result, pose a low risk of transmission of SARS-CoV-2 to the general population. Therefore, our study suggests that the testing of asymptomatic children is, ultimately, a low-yield practice in the efforts to mitigate spread of SARS-CoV-2. While many school systems have chosen to eliminate mandatory testing, this change has not been universally adopted by school systems.

An inherent limitation to our study is the reliability of molecular testing for SARS-CoV-2 infection. Although our sample population is large, the occurrence of false-negative or false-positive results may interfere with our results. Another limitation of our study is that it examined a cohort of children solely from a metropolitan population. However, by taking this population as our cohort, our study is better able to serve as a tool for metropolitan populations. We acknowledge that 70% of the study population was commercially insured, which may hinder the generalizability of our results to the broader population. Another limitation to our chosen study population is the possibility that patients may have engaged in cautionary behaviors prior to surgery to ensure that they did not become sick. For example, patients may have chosen to avoid social gatherings or travel prior to surgery, which would lower the chance of exposure to COVID-19. While this is a possibility, our results remain important, because they stress the low rate of SARS-CoV-2 infection in a population which otherwise closely reflects the health status of children attending school. Children undergoing elective or semi-elective otolaryngologic surgery are commonly afflicted with recurrent colds, ear infections, or sore throats, similar to ailments common in the general pediatric population. Therefore, the health status of our population closely mirrors the health status of the average child. One caveat is the possibility that patients undergoing surgery earlier in the time frame analyzed might have had more serious conditions warranting surgery; this population of patients may not be as representative of the general pediatric population. Overall, we know of no other research which has examined the rate of SARS-CoV-2 infection in a population of asymptomatic children in New York City such as ours in this reflective time following the multiple waves of the COVID-19 pandemic.

## 5 | CONCLUSION

Our study sheds light on the ambiguity surrounding the role of testing asymptomatic children as a practice. Given the low incidence of asymptomatic disease throughout all phases of the pandemic and the low risk of transmission in the study population, it is unlikely that testing asymptomatic children can play a central role in mitigating transmission of SARS-CoV-2. In fact, the costs of surveillance testing—both financially and in terms of testing anxiety experienced by children—may exceed the benefits. Our results suggest that the testing of asymptomatic children is a low-yield practice; other studies have shown the low rate of transmission to and from children

following exposure to SARS-CoV-2. The current recommendation from the CDC is masking for children with exposure to any individual with COVID-19.<sup>16</sup> Our study raises the possibility that the rate of transmission of SARS-CoV-2 in asymptomatic children is so low that even masking for children following COVID-19 exposure may not be warranted.

The results of this study encourage us to question and further explore the utility of testing asymptomatic children and masking practices among pediatric populations, in pursuit of ensuring effective practices and mitigating those that prove to be futile in the continuing age of the COVID-19 pandemic. We believe that decisions regarding the testing of asymptomatic children, school closings, social distancing, or any measure pertaining to pediatric populations should be based on data about the current infection rate in the community with the knowledge that children have a low rate of asymptomatic disease and, therefore, pose a low risk of transmission of SARS-CoV-2 to the general population.

### CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

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